Basics of Dust Control and Wind Erosion

Dallas Grossman
Division of Water Quality
(701) 328-5242

NORTH DAKOTA
DEPARTMENT *of* HEALTH

NDR10-0000

PART II – STORM WATER DISCHARGE REQUIREMENTS

C. Storm Water Pollution Prevention Plans

2. Operational Controls

a. Good housekeeping practices to maintain a clean and orderly facility. Litter, debris, chemicals and parts must be handled properly to minimize the exposure to storm water. This includes measures to reduce and clean up vehicle tracking of sediment off-site and **generation of dust**.

Wind Erosion

- Major contributor to erosion of fine-grain soils.
- A thick layer of accumulated sand and silt may not support plant growth.

Wind Erosion

- Wind erosion can be a problem in most states.

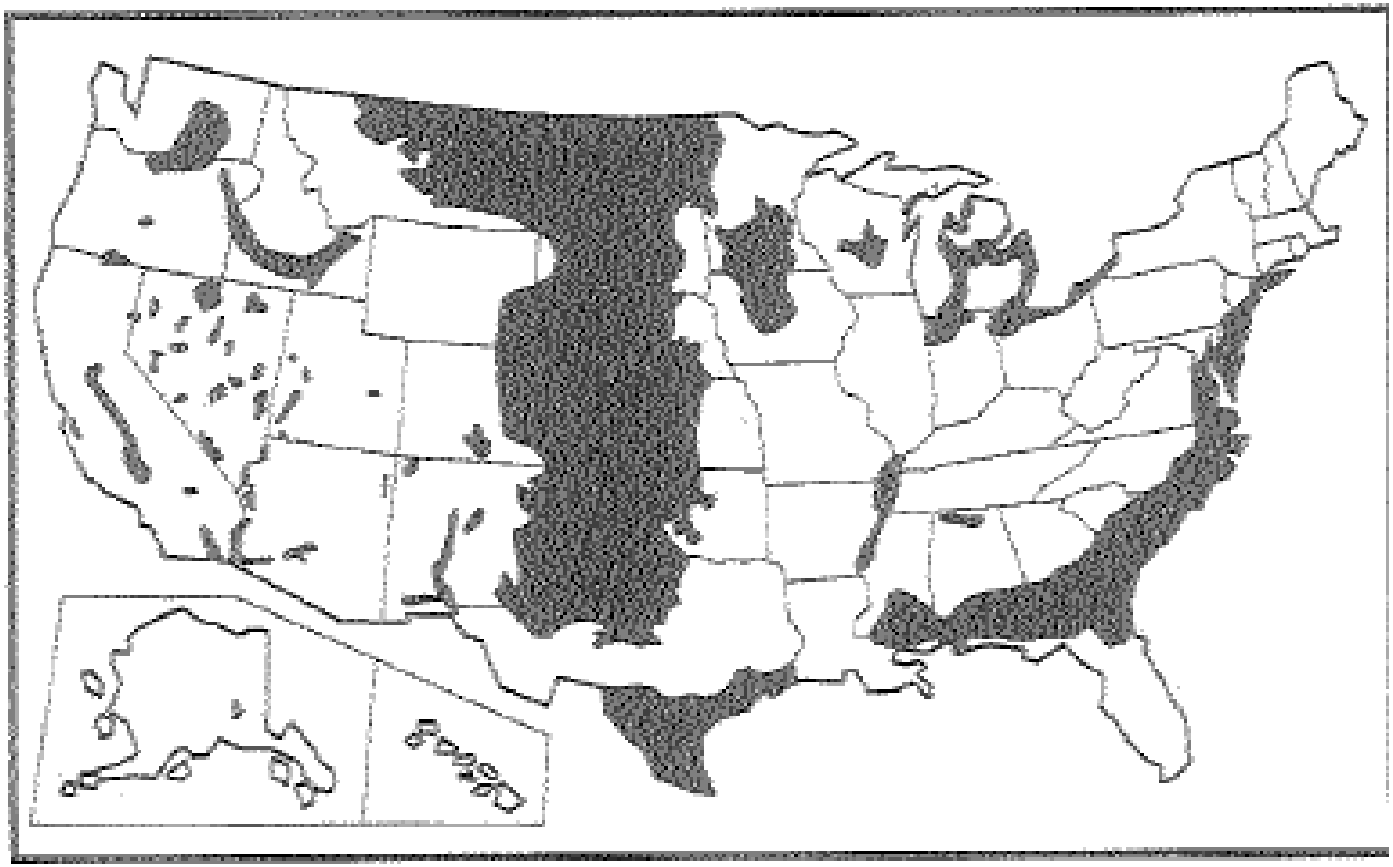


Figure 39. Areas of Highest Potential for Wind Erosion (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Wind Erosion

- An issue during dry conditions when soil is exposed to wind.
- Unlike water-borne sediment, wind-borne sediment does not flow downhill.

Wind Erosion

Methods of Soil Particle Transportation

- Surface Creep
- Saltation
- Suspension

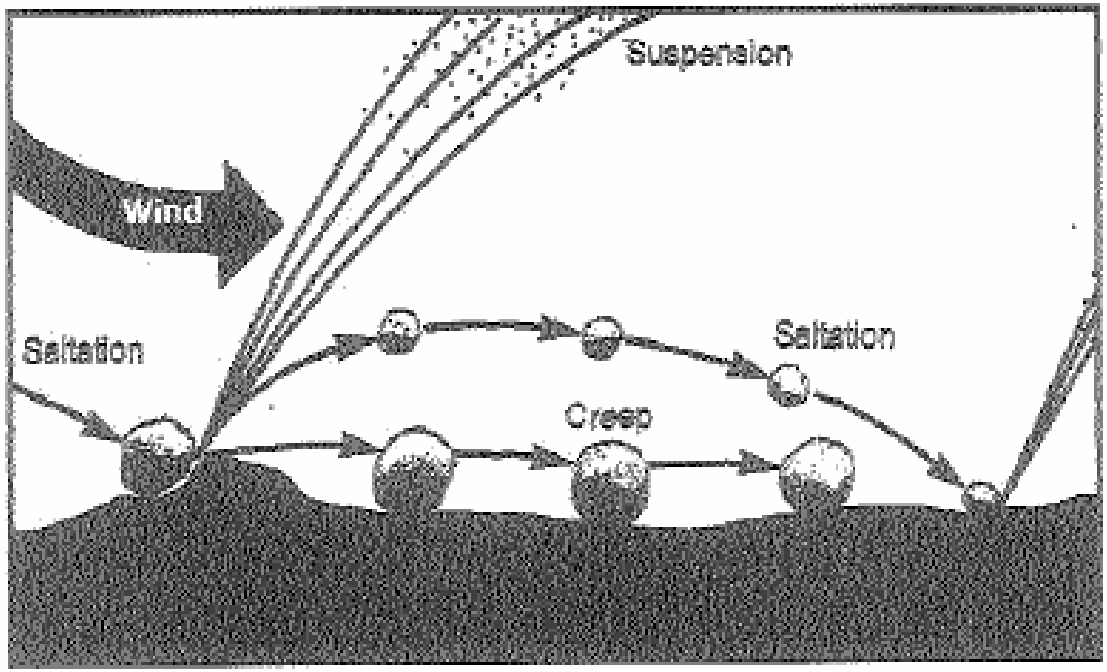


Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Surface Creep

- The rolling and sliding movement of particles across a surface.
- Can represent 5 – 25% of total soil loss from a construction site.

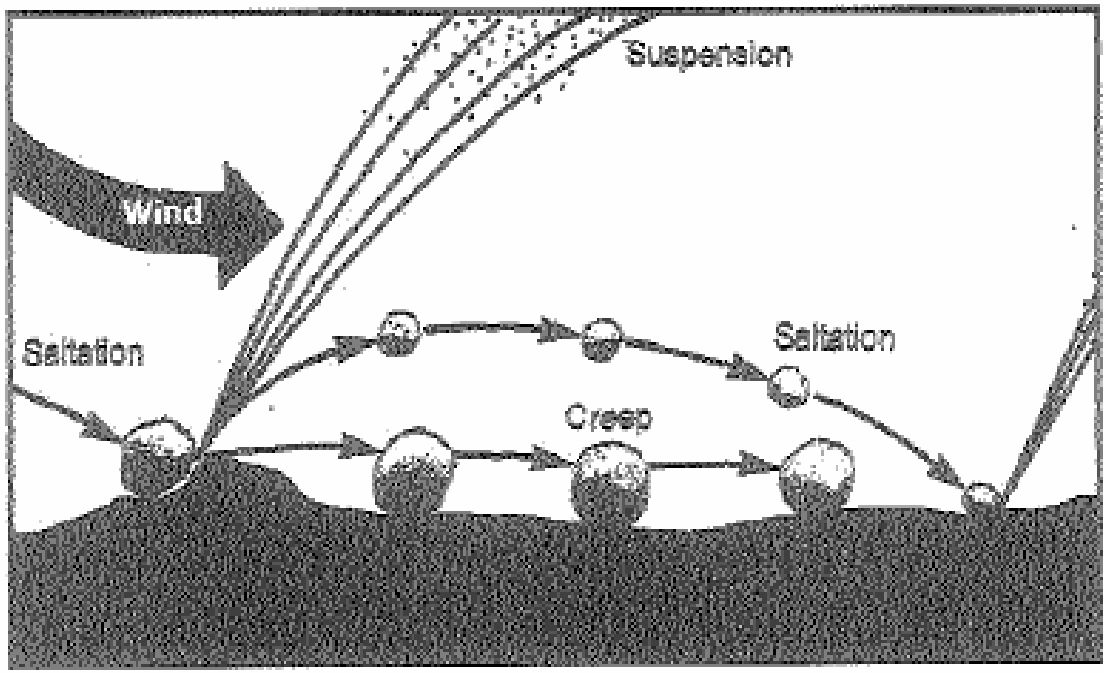


Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Saltation

- The hopping and bouncing movement of particles.
- The particles are small enough to be lifted by wind, but are too large to stay in the air.
- Upon returning to the ground they dislodge more particles.
- Can represent approximately 50 – 80% of total soil loss due to wind.

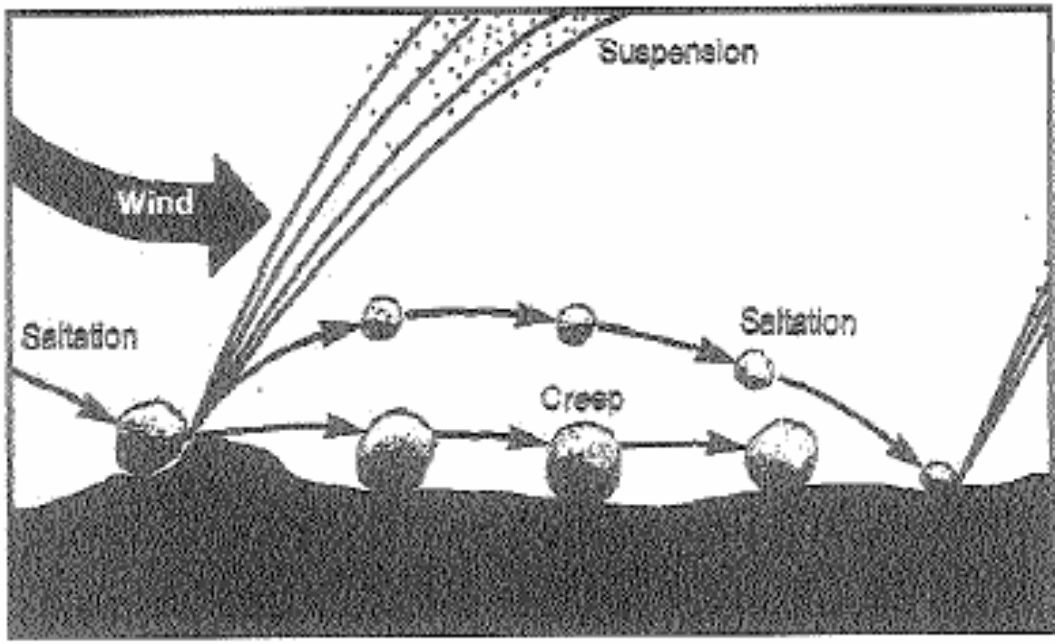


Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Suspension

- Particles small enough to be suspended by wind.
- Remain in suspension for long durations and can travel great distances.
- Can represent less than 10% of total soil loss due to wind.

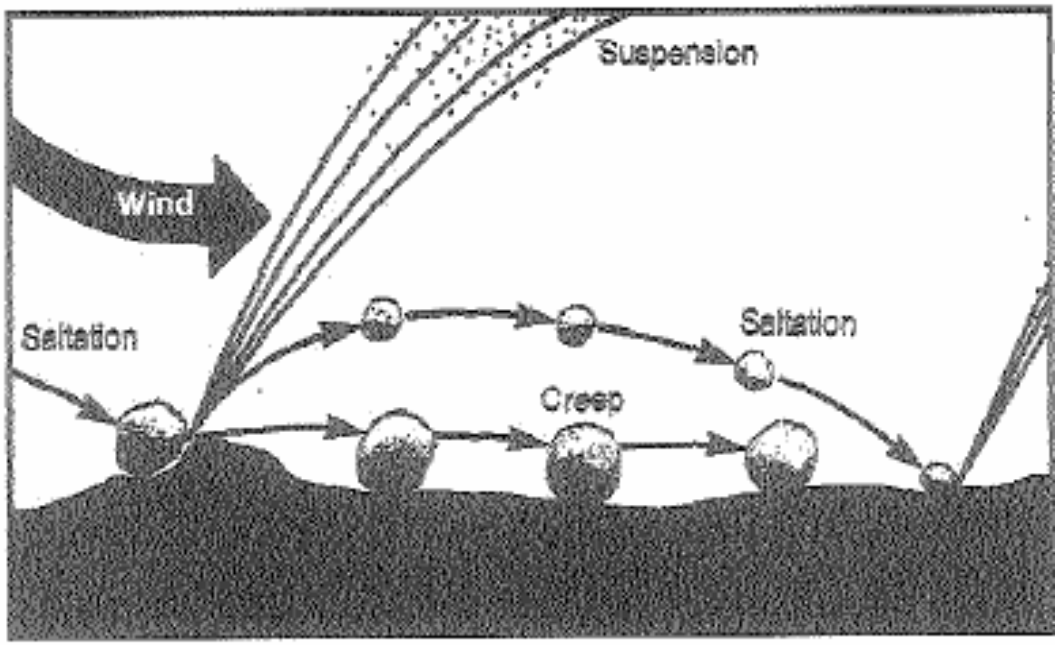


Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Size Distribution

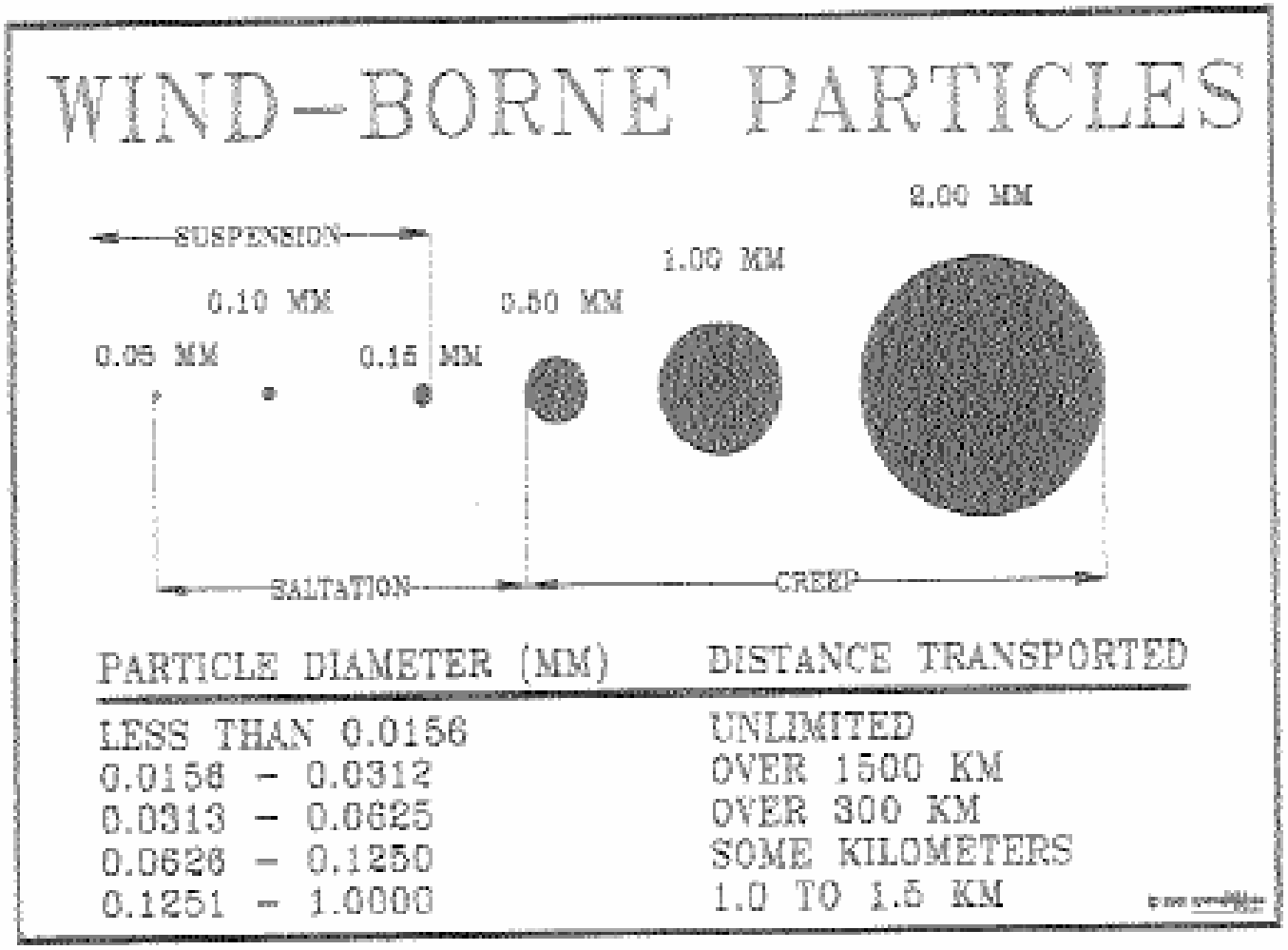


Figure 41. Relative Size Distribution of Wind-Borne Particles (Fifield, 1995)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Erosion Rates

- Depend on erodibility of the soil and erosivity of the wind.
- Erosivity falls into two categories
  1. Atmospheric Flow
     - The rate of soil movement is proportional to the cube of the wind velocity.
     - Think of the velocity of a river in the middle of the channel versus along the bank.
     - Also, the wind speed required sustain soil movement, is less than the speed required to start soil movement.
  2. Surface Roughness
     - Five major categories: vegetation, clods and non-erodible fractions, ridges, field shelterbelts (or windbreaks), and local changes in topography.

Surface Roughness

1. Vegetation height and density
   - Determines the extent wind contacts the soil surface
2. Clods and non-erodible fractions
   - Provide cover for smaller soil particles
3. Ridges
   - Shelter and trap suspended particles when the wind is perpendicular to them
   - Provide little protection when wind is parallel to them
4. Field shelterbelts or windbreaks
   - Intercept suspended particles
   - Particles deposit on the leeward side of the barrier
5. Local changes in topography

Erodibility

- Erodibility of soil is dependent upon
  - Diameter
  - Density
  - Shape
- Most soil is held together in clods in the following ways:
  - Water tends to hold soil grains together
    - Sands tend to dry quickly
    - Finer grains retain moisture longer and are more cohesive
  - Texture relates to a soil's moisture-retention capability
    - More silt and clay results in more clods
    - More sand results in fewer clods
  - Organic cements resulting from breakdown of organic material
  - Desegregating processes
    - Freeze-thaw breaks down clods

Minimizing Wind Erosion

- Things to consider:
  - Control methods available during major grading activities
  - Control methods to use after major grading activities
  - Amount of area exposed
  - Dust generating activities (cutting concrete)
  - Location (near populated areas)
  - Time of year
  - Type of people affected
    - People with health issues
    - “Concerned citizens”

Control Methods

- Minimize amount of soil exposed
- Mulch and seeding
- Mulch
- Structural Barrier and windbreaks
- Surface Roughening
- Dust suppression chemicals
- Water

Mulch

- Straw or other organic material.

Mulch

- In order to prevent mulch from blowing away, it should be disc-anchored into the soil, hydraulically bonded, or covered with netting and stapled.
- Mulch may help when optimum germinations conditions do not exist (i.e., midsummer, early winter).

Structural Barrier and Windbreaks

- There is a deposition zone of 10 feet for every 1 foot of fence.
  - Soil Deposition = 10 x H
- Spacing between barriers depends on soil erodibility.
  - Low = 1,000 ft
  - Moderate = 200 ft
  - High = 50 ft
- The best sediment collection occurs when 40% to 50% of the fence is open.

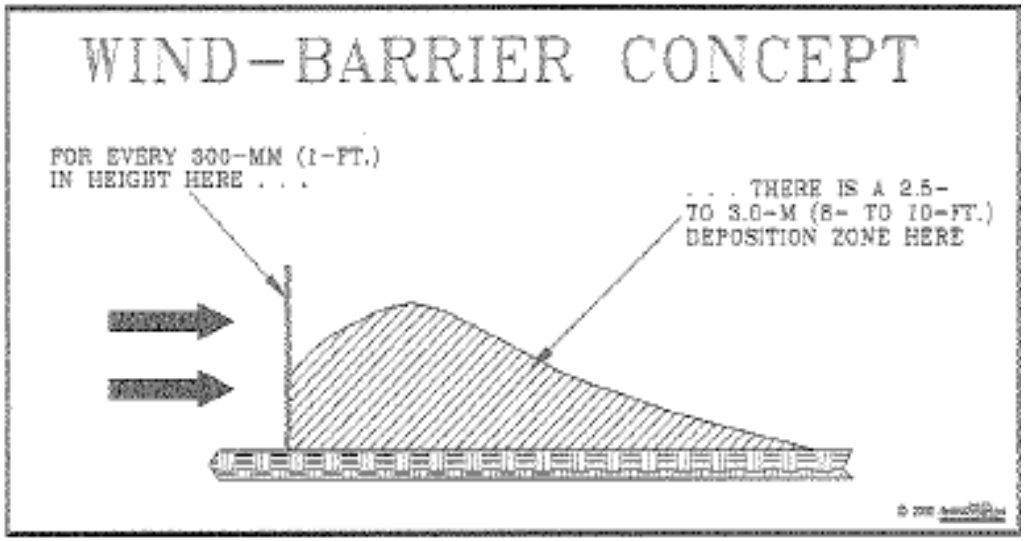
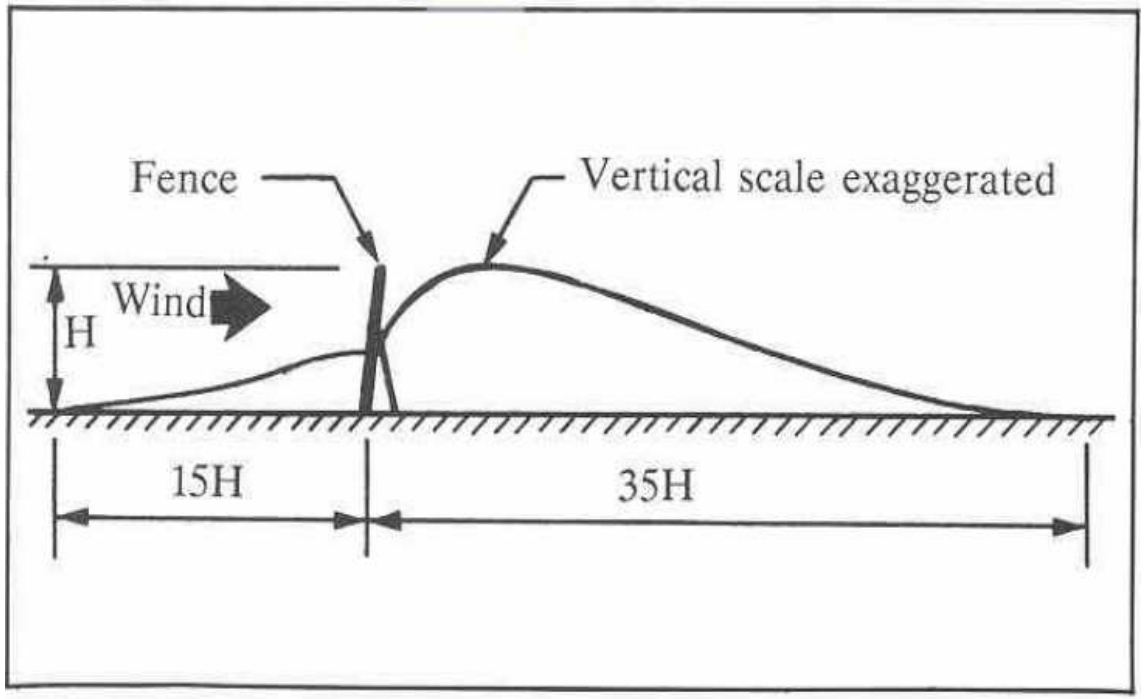


Figure 42. Impact of Barriers on Deposition of Wind-Borne Sediments (Fifield, 1996)

Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors, Fifield, 2002

Structural Barrier and Windbreaks

- Caution should be used when placing barriers before snow fall. Then the deposition zone is 35 feet for every 1 foot of fence.
  - Snow Deposition = 35 x H



©1987 Tabler & Associates

Snow Fence Guide, Tabler, 1991

Control Methods

- Surface Roughening
  - Construct ridges perpendicular to the prevailing wind or to the direction you want to protect.
  - Ridges should be 6 inches in height.
- Dust Suppression Chemicals
  - Consult with the North Dakota Department of Health before using.
- Water
  - Useful when equipment is available


36 mph winds
4/6/2006


36 mph winds
4/6/2006
ASPEN
Group
REAL ESTATE SERVICES
223-2450


36 mph winds
4/6/2006
43 AVE NE
ASH COULEE DR
KNUTSON HOMES
EAGLE CREST
ON ASH COULEE DR.
presented by:
Boulder Ridge Development, Inc.
Contact:
Jack Knutson
office: 258-3464
cell: 220-9266


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006


36 mph winds
4/6/2006

Questions?

References

- Designing for Effective Sediment and Erosion Control on Construction Sites; Jerald S. Fifield; 2001
- Field Manual on Sediment and Erosion Control Best Management Practices for Contractors and Inspectors; Jerald S. Fifield; 2002
- SHRP-W/FR-91-106, Snow Fence Guide; Ronald D. Tabler, Tabler & Associates; 1991
- Protecting Water Quality in Urban Areas; MPCA; 2000